

# **Overview of NOS Work with Linkages to Coastal Resilience and Natural and Nature-based Solutions**

**Jeff Payne**  
**NOAA Office for Coastal Management**





# Healthy Coasts - Critical for Nation's Vitality

The coast has

- 23 of the 25 most densely populated counties
- 19 out of 20 major cities
- 45% of our GDP
- 51 million jobs
- 9 of 10 most costly storms





# A Very Real Need





# NOAA National Ocean Service

## Meeting the nation's coastal management needs

- Coastal Resilience: preparing, responding, recovering
- Coastal Intelligence: informing
- Place-based Conservation: preserving





# Natural and Nature-based Solutions

- Valuable approaches for reducing flood hazards
- Increase resilience
- Reduce risk





# Multiple Approaches, Multiple Services



← **Dune or Oyster  
Reef Restoration**





OFFICE FOR COASTAL MANAGEMENT

# Coastal Green Infrastructure





# Partnerships are Critical









# SAGE - Community of Practice

Tuesday, February 02, 2016

Google™ Custom Search



• ABOUT SAGE

• USER TOOLS

SAGE ACTIVITIES

SCIENCE & ENGINEERING

POLICY

HOME



## Systems Approach to Geomorphic Engineering

*Integrating green and gray solutions in coastal landscape transformation*



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# Conserving and Greening the Coast

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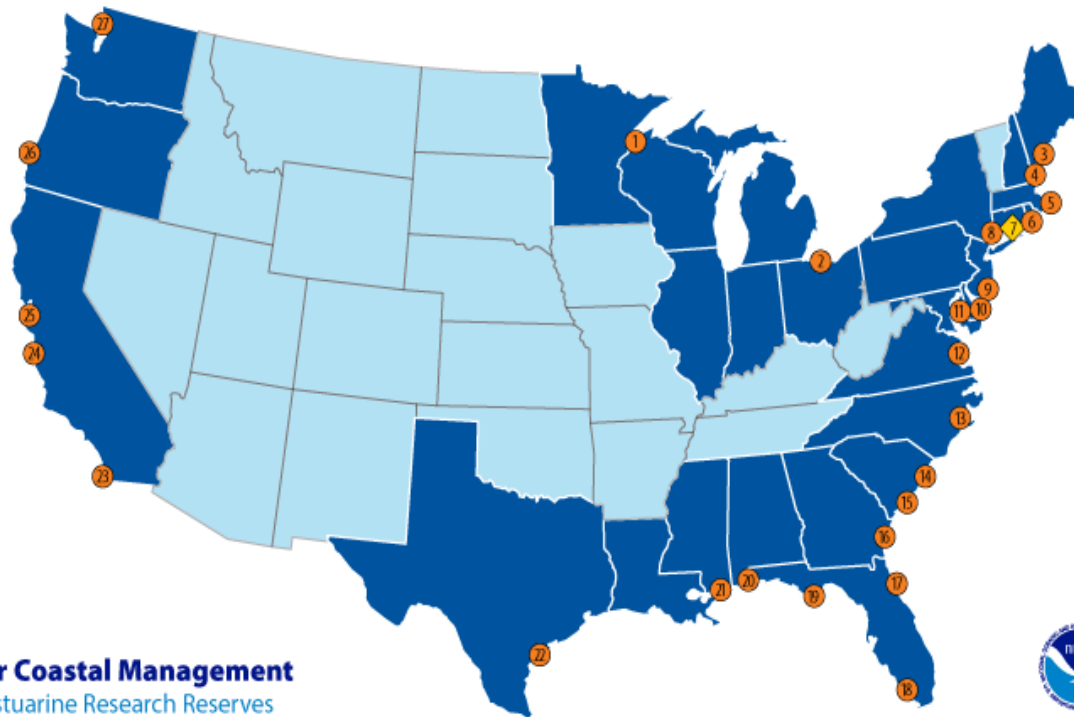
## Coastal Zone Management Program

Balancing economic growth and  
environmental sustainability



# Conserving and Greening the Coast

## National Estuarine Research Reserve System



**Office for Coastal Management**  
National Estuarine Research Reserves



Northern  
Mariana  
Islands

American  
Samoa

Guam

Alaska

Hawaii

Puerto  
Rico

U.S. Virgin  
Islands





# Digital Coast – What Makes it Work



**Focus on coastal management community**

Full suite of helpful data, tools, training, and resources

**DIGITAL COAST PARTNERSHIP**

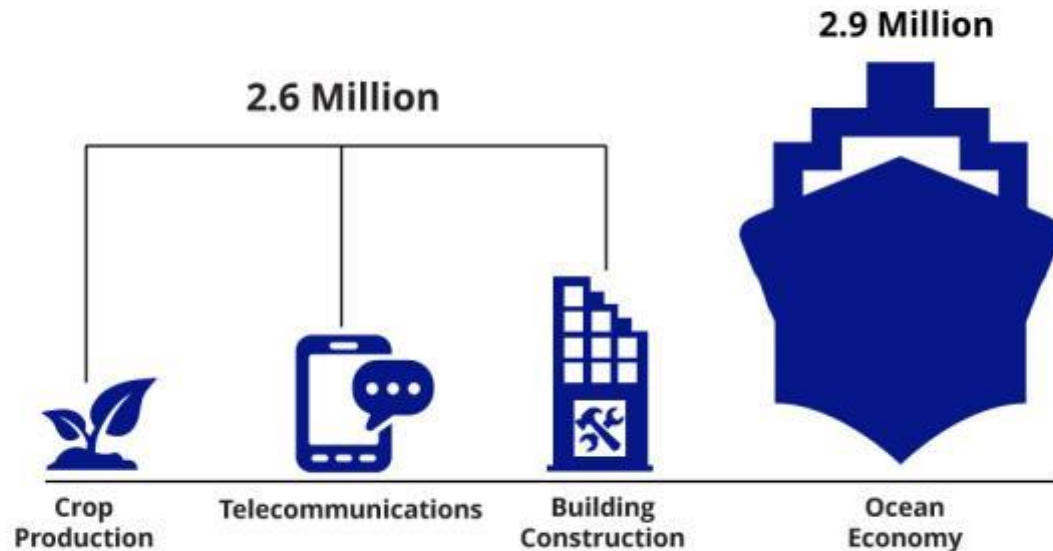




# Data

The U.S. Ocean and Great Lakes Economy is large

## U.S. Total Employment Comparison





# Data



## COASTAL LAND COVER AND LAND CHANGE DATA



Providing the Best Big Picture View Available

**1,535 square miles | 23,274 square miles**  
**5,726 square miles**

**65,000 square miles**





# Coastal Land Cover and Land Change Data

National inventory of land cover and change

Added focus on coastal detail and change

NOAA maps 25% of contiguous U.S.

Coastal area accounts for

- 66% of all wetlands
- 41% of all development
- 44% of all change (2001-2010)

Detailed wetlands and change mapping

Higher resolution in Pacific and Caribbean





# Coastal Land Cover and Land Change Data

## Coastal Land Cover Applications

## Interagency Coastal Wetlands Workgroup

## Land Cover Atlas

[coast.noaa.gov/digitalcoast/tools/lca](http://coast.noaa.gov/digitalcoast/tools/lca)

## Sea Level Rise Viewer

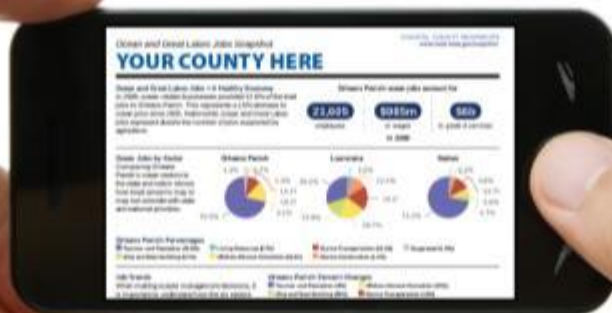
[coast.noaa.gov/digitalcoast/tools/slr](http://coast.noaa.gov/digitalcoast/tools/slr)





# Tools

## Coastal County Snapshots



## Coastal Flood Exposure Mapper



## OpenNSPECT

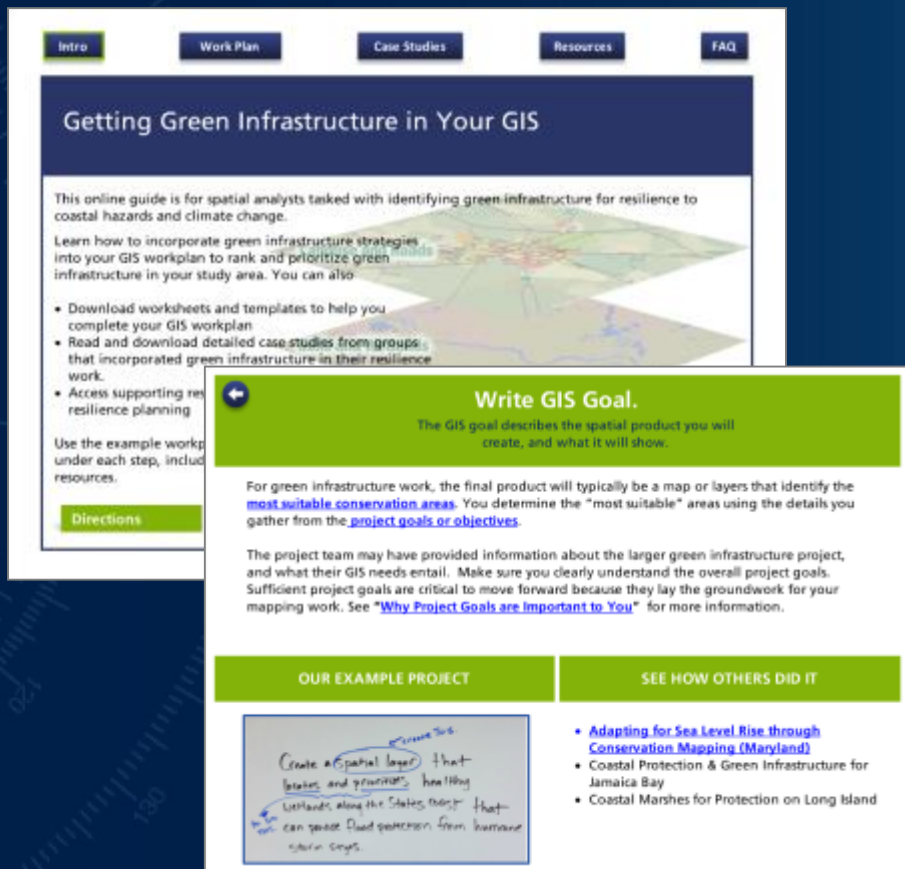


## Sea Level Rise Viewer





# Training



**Getting Green Infrastructure in Your GIS**

This online guide is for spatial analysts tasked with identifying green infrastructure for resilience to coastal hazards and climate change. Learn how to incorporate green infrastructure strategies into your GIS workplan to rank and prioritize green infrastructure in your study area. You can also:

- Download worksheets and templates to help you complete your GIS workplan
- Read and download detailed case studies from groups that incorporated green infrastructure in their resilience work.
- Access supporting resilience planning

Use the example workplan under each step, including resources.

**Directions**

**Write GIS Goal.**  
The GIS goal describes the spatial product you will create, and what it will show.

For green infrastructure work, the final product will typically be a map or layers that identify the most suitable conservation areas. You determine the "most suitable" areas using the details you gather from the project goals or objectives.

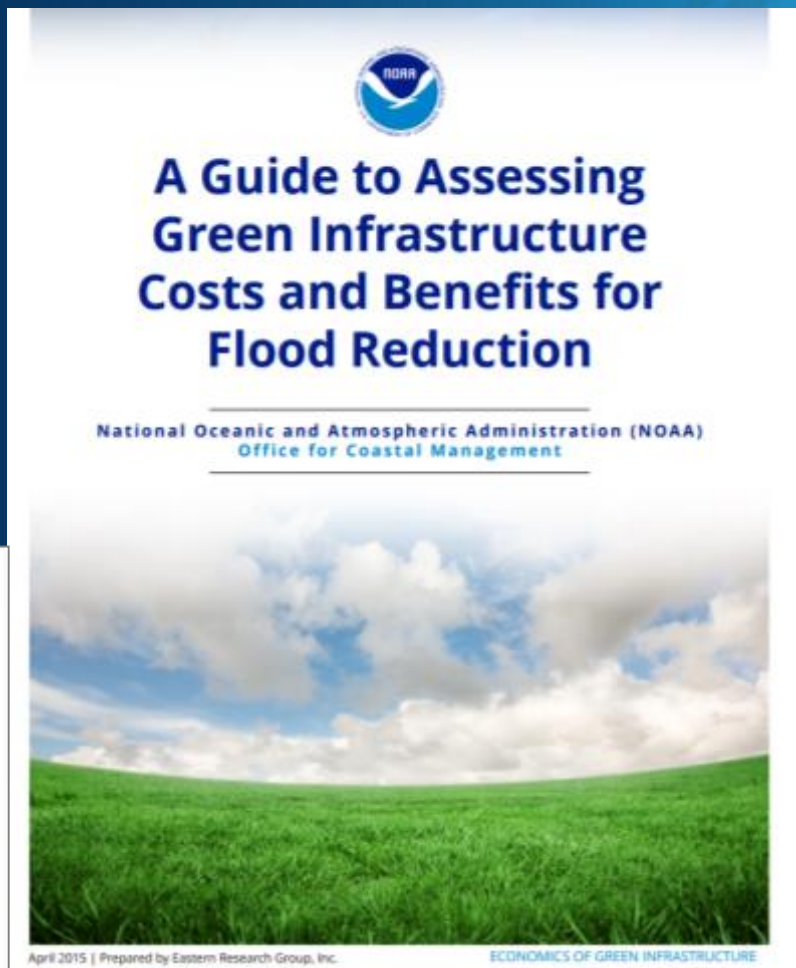
The project team may have provided information about the larger green infrastructure project, and what their GIS needs entail. Make sure you clearly understand the overall project goals. Sufficient project goals are critical to move forward because they lay the groundwork for your mapping work. See "Why Project Goals are Important to You" for more information.

**OUR EXAMPLE PROJECT**

Create a spatial layer that labels and prioritizes wetlands along the States coast that can provide flood protection from hurricane storm surges.

**SEE HOW OTHERS DID IT**

- Adapting for Sea Level Rise through Conservation Mapping (Maryland)
- Coastal Protection & Green Infrastructure for Jamaica Bay
- Coastal Marshes for Protection on Long Island



**A Guide to Assessing Green Infrastructure Costs and Benefits for Flood Reduction**

National Oceanic and Atmospheric Administration (NOAA)  
Office for Coastal Management

April 2015 | Prepared by Eastern Research Group, Inc.

ECONOMICS OF GREEN INFRASTRUCTURE

# Methodologies





# NOAA Coastal Resilience Grants Program

- Nature based solutions
- Geospatial data and tool development
- Economic research





# NOAA Coastal Resilience Grants Program



RESILIENCE MEANS ***BOUNCING BACK***

**BEFORE THE STORM**



**DURING THE STORM**



**AFTER THE STORM**



***BOUNCING BACK***







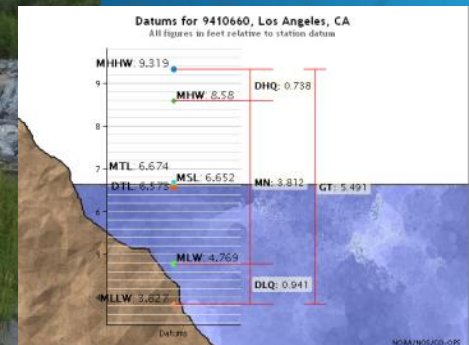
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# NOAA's National Ocean Service

*Applying NOAA NOS Coastal Intelligence to inform planning and implementation of NNBF*



Richard Edwing, Director

Center For Operational Oceanographic Products and Services



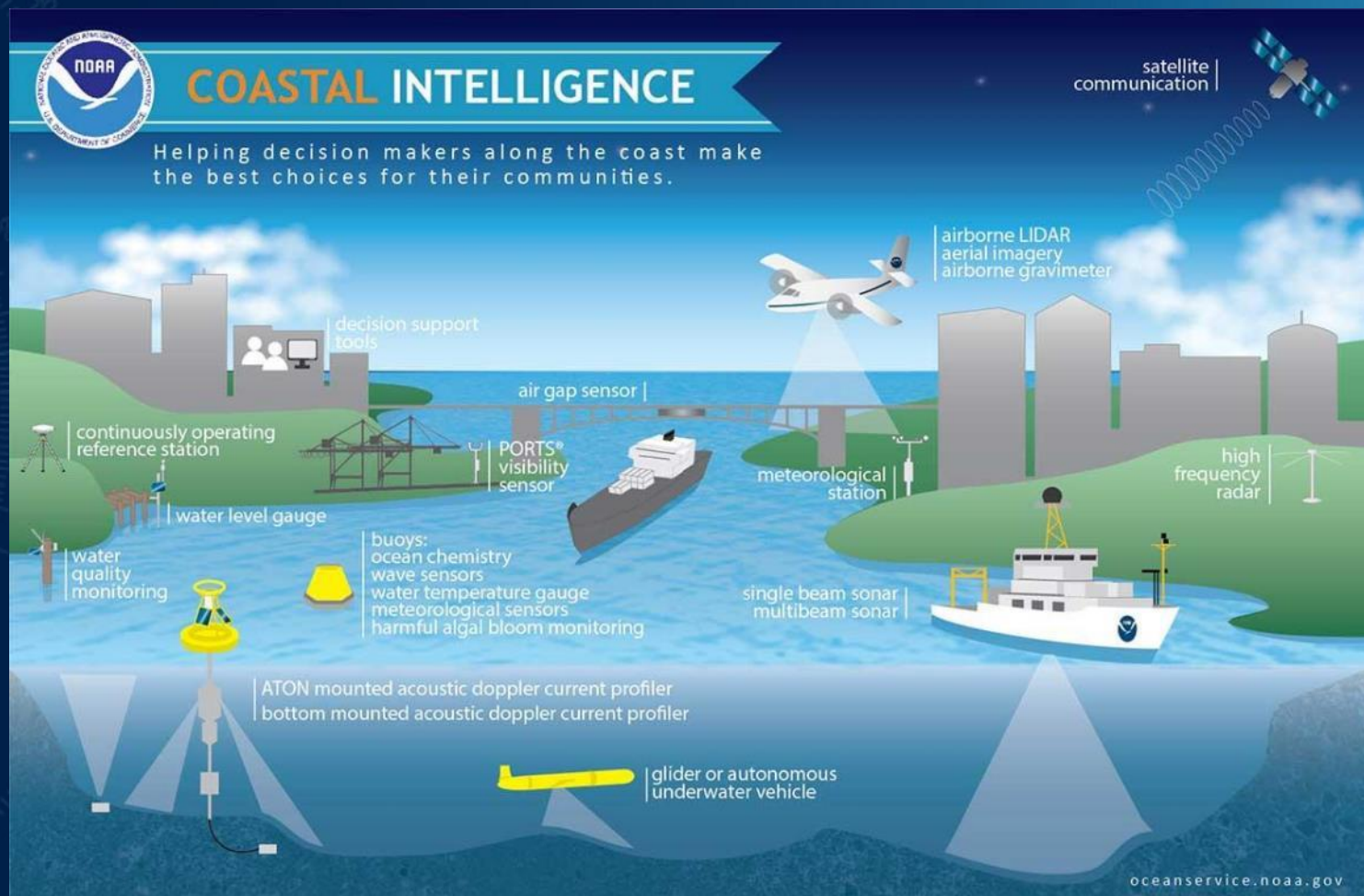
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# NOS Coastal Intelligence

Advancing resilience and natural infrastructure





# NOS Coastal Intelligence

Advancing resilience and natural infrastructure



National Spatial Reference Frame (NRSF)



System-Wide Monitoring Program (SWMP)



National Water Level Observation Network (NWLON)



Remote Sensing



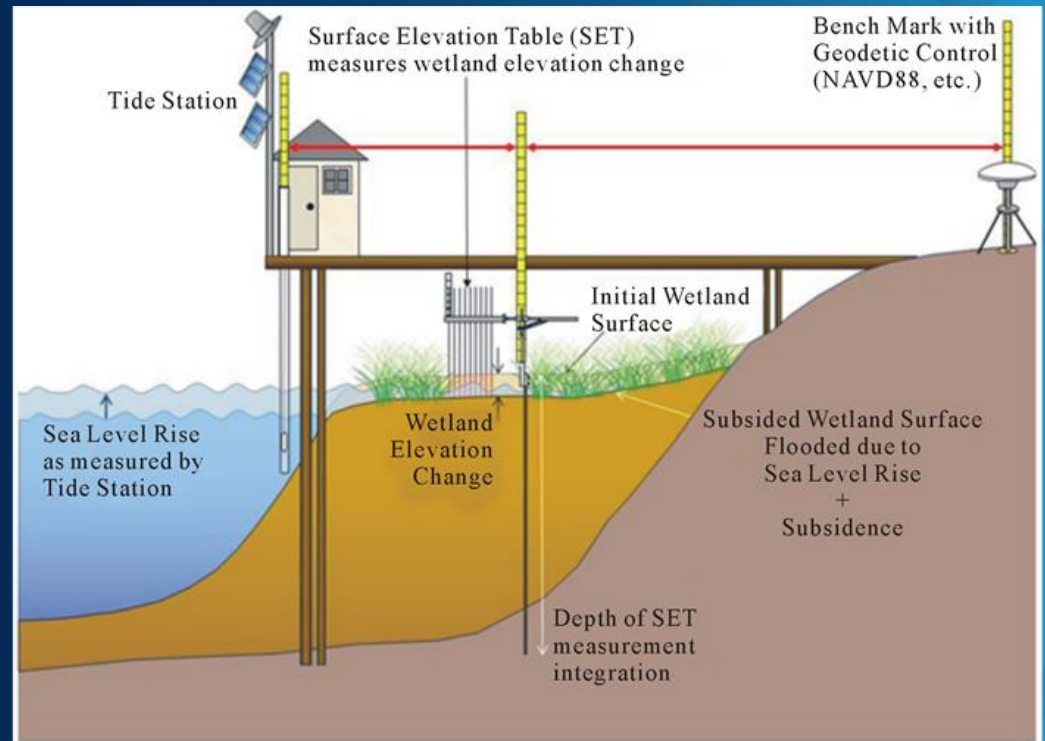


# Applying Coastal Intelligence to NNBF

Advancing resilience and natural infrastructure



## NOAA Sentinel Sites



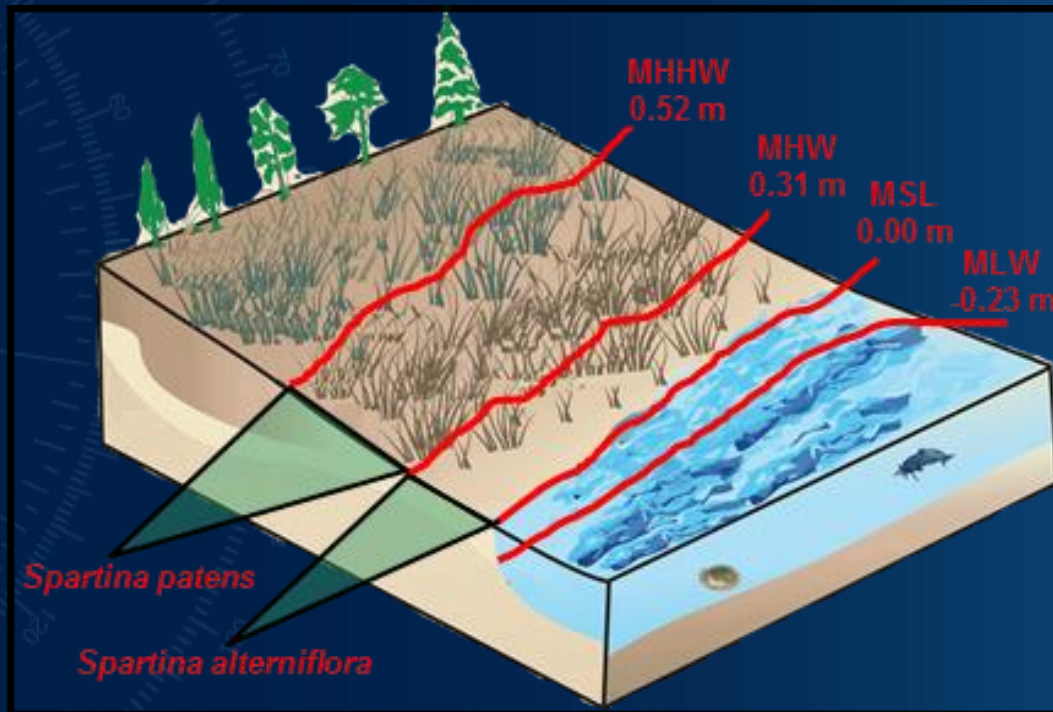
## Sentinel Station Cross Section





# Applying Coastal Intelligence to NNBF

Advancing resilience and natural infrastructure



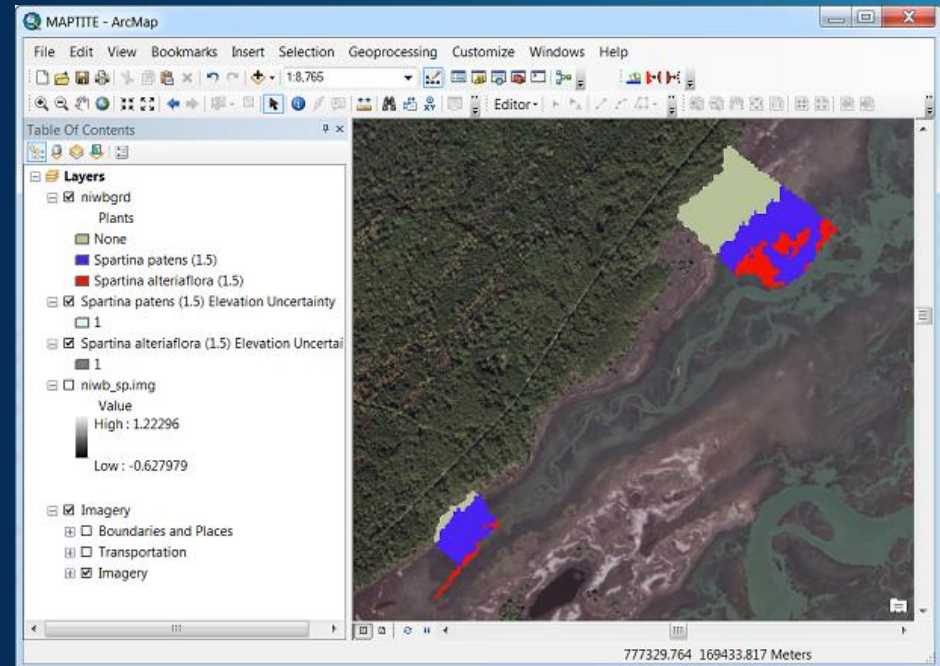
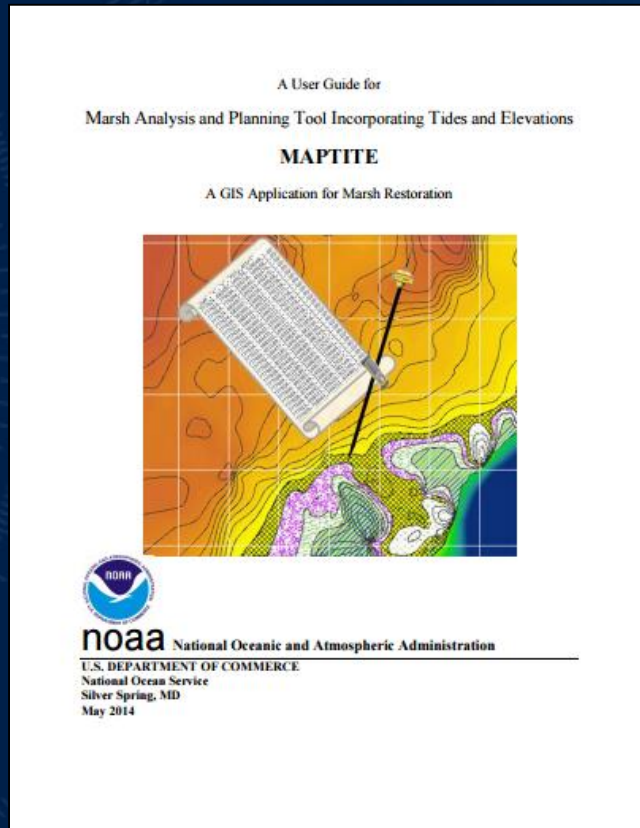
Establishing water and land based datums to support Nature Based Infrastructure





# Applying Coastal Intelligence to NNBF

Advancing resilience and natural infrastructure



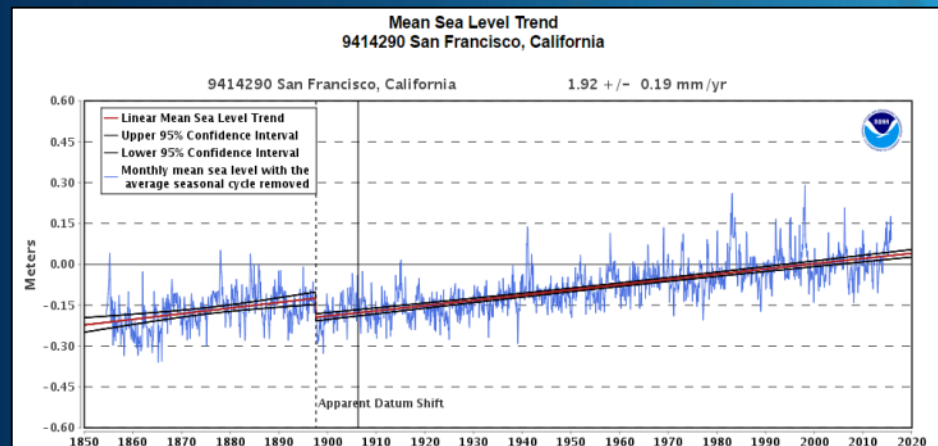
Marsh Analysis and Planning Tool Incorporating  
Tides and Elevations (MAPTITE)



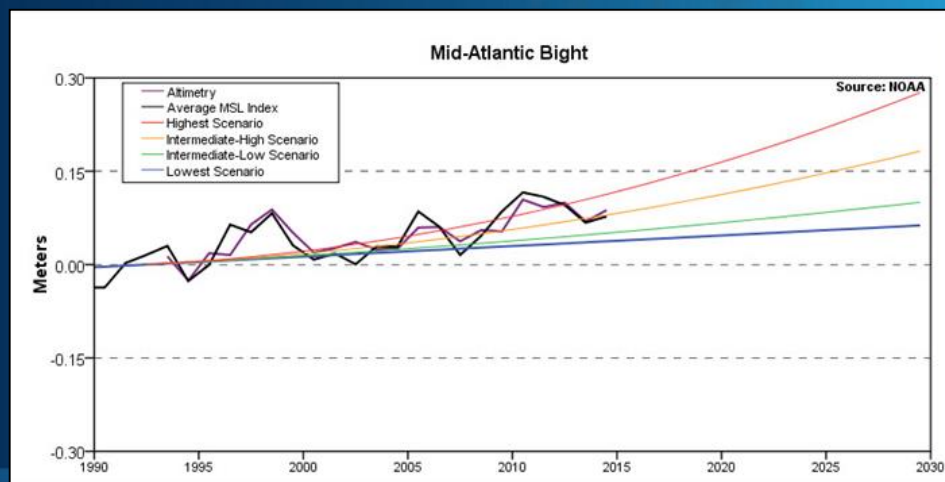


# Applying Coastal Intelligence to NNBF

Advancing resilience and natural infrastructure



Provide current and future trends to ensure long term project viability





# Examples of NOS-USACE Collaboration

## Advancing resilience and natural infrastructure

[http://tidesandcurrents.noaa.gov/publications/NOAA\\_Technical\\_Report\\_NOS\\_COOPS\\_076.pdf](http://tidesandcurrents.noaa.gov/publications/NOAA_Technical_Report_NOS_COOPS_076.pdf)

NOAA Technical Report NOS CO-OPS 076

### Water Level Variations at Poplar Island, MD



Silver Spring, Maryland

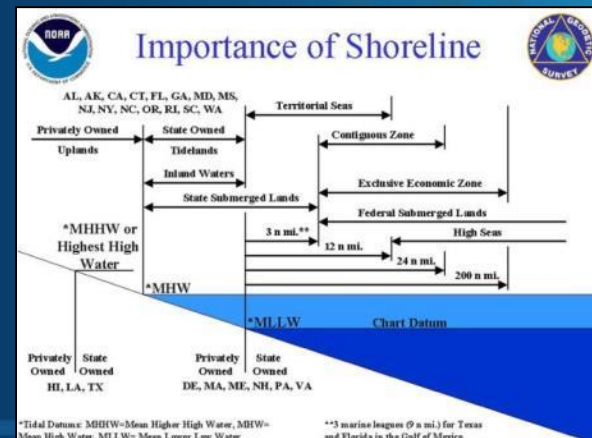
April 2015



**noaa** National Oceanic and Atmospheric Administration

U.S. DEPARTMENT OF COMMERCE  
National Ocean Service  
Center for Operational Oceanographic Products and Services

- Supporting USACE with adoption of national tidal and geodetic datums through engineering regulations and circulars and applying them to national infrastructure investments
- Poplar Island Water Level Variation Study
- Leveraging work to advance airborne lidar and coastal mapping and charting technology and applications and maintaining the National Shoreline



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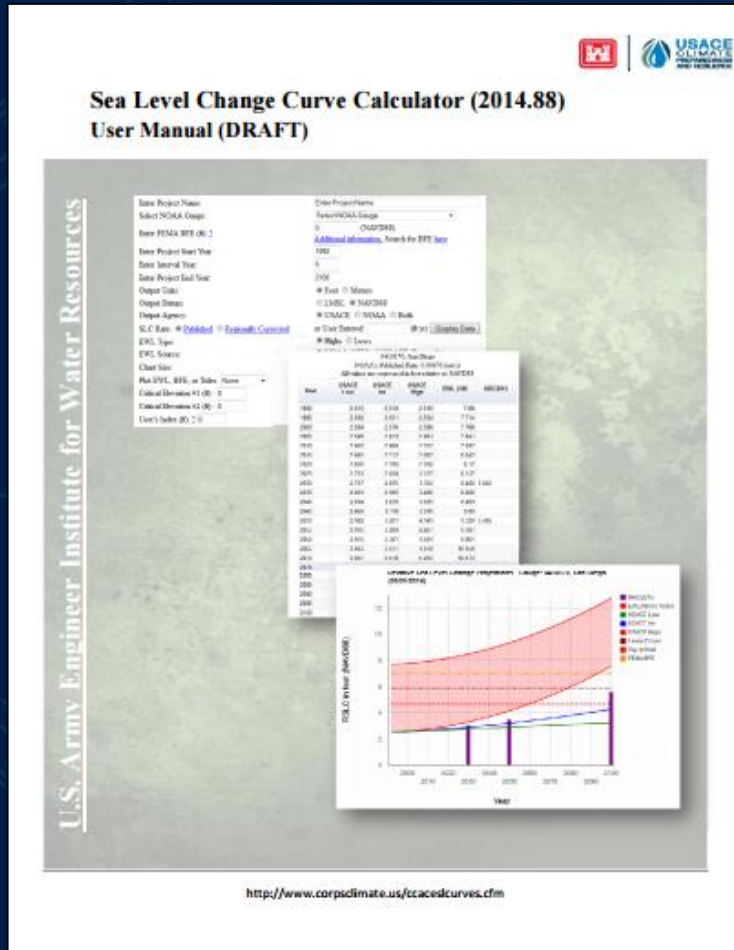
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# Examples of NOS-USACE Collaboration

## Advancing resilience and natural infrastructure

- Supporting the development of the sea level and extreme water level technical letters.
- Providing input and extreme water level statistical analysis to support the development of the USACE Sea Level Change Curve Calculator



DEPARTMENT OF THE ARMY  
U.S. Army Corps of Engineers  
Washington, DC 20314-1000

CECW-CE  
CECW-P

Technical Letter  
No. 1100-2-1

ETL 1100-2-1  
30 June 2014

EXPIRATION DATE (30 March 2019)  
Global Changes  
PROCEDURES TO EVALUATE SEA LEVEL CHANGE:  
IMPACTS, RESPONSES, AND ADAPTATION

1. **Purpose.** This technical letter provides guidance for understanding the direct and indirect physical and ecological effects of projected future sea level change on USACE projects and systems of projects and considerations for adapting to those effects.

2. **Applicability.** This Engineer Technical Letter (ETL) applies to all USACE elements having responsibility for Civil Works.

3. **Distribution Statement.** Approved for public release; distribution is unlimited.

4. **References.** References are listed in Appendix A.

5. **Discussion.** USACE missions, operations, programs, and projects must be resilient to coastal climate change effects, beginning with sea level change (SLC). This ETL addresses adaptation to changing sea levels for every USACE coastal activity as far inland as the extent of estimated tidal influence. It includes a broadly applicable method encompassing four USACE mission areas and also provides insight into use for multipurpose projects. The information presented here is applicable to the full range of USACE projects and systems, from simple to complex, from small to very large, and over the full life cycle. This ETL integrates the recommended planning and engineering to understand and adapt to impacts of projected SLC through a hierarchy of decisions and review points that identify the level of analysis required as a function of project type, planning horizon, and potential consequences.

FOR THE COMMANDER:

7 Appendices  
See Table of Contents

*James C. Dalton*  
JAMES C. DALTON, P.E., SES  
Chief, Engineering and Construction Division  
Directorate of Civil Works





# Coastal Intelligence Partnerships

## Advancing resilience and natural infrastructure



- A growing need for common standards, particularly around water level information for use primarily for SLR and extreme events
- NOS has been fostering partnership with Federal Agencies, move forwards on outlining data standards and looking at monitoring through tiered data perspective
- USACE and NOAA have already made progress with sharing common standards.



**US Army Corps  
of Engineers®**





# Science Supporting Coastal Resilience and Natural and Nature-based Features

**Mary Erickson**

Director, National Centers for Coastal Ocean Science

**USACE/NOAA-NOS Collaboration Workshop on Natural and Nature-Based Features**

March 1-3, 2016





# Overview

- NOS Science Approach
- Core NNBF Science Capabilities
- Emerging Opportunities





# NOS Science Approach

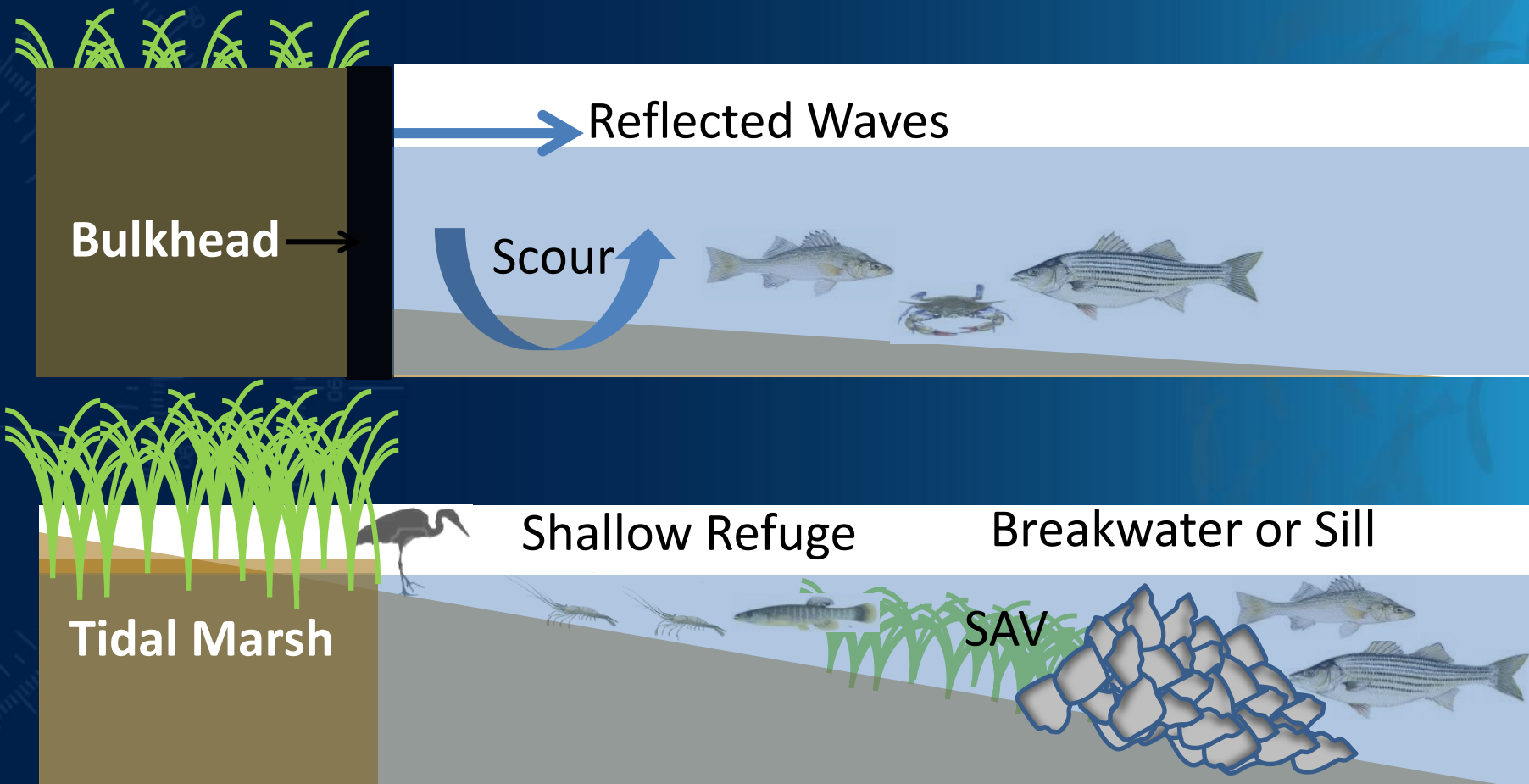
- Science to inform coastal preparedness for coastal storms, hazards, and the effects of climate change
- Internal and External science capacity
  - Competitive science programs
  - National Estuarine Research Reserve System Science Collaborative





# Applied Science

What are the impacts of shoreline hardening?



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Smithsonian Environmental  
Research Center





# Applied Science

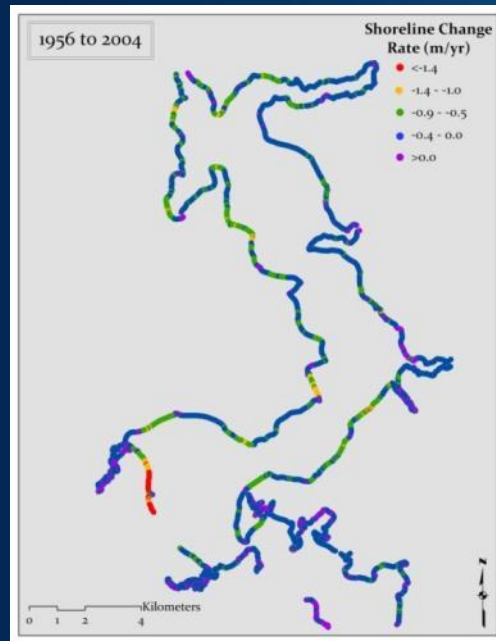
Where are marshes most resilient to erosion?

Estuary Shoreline



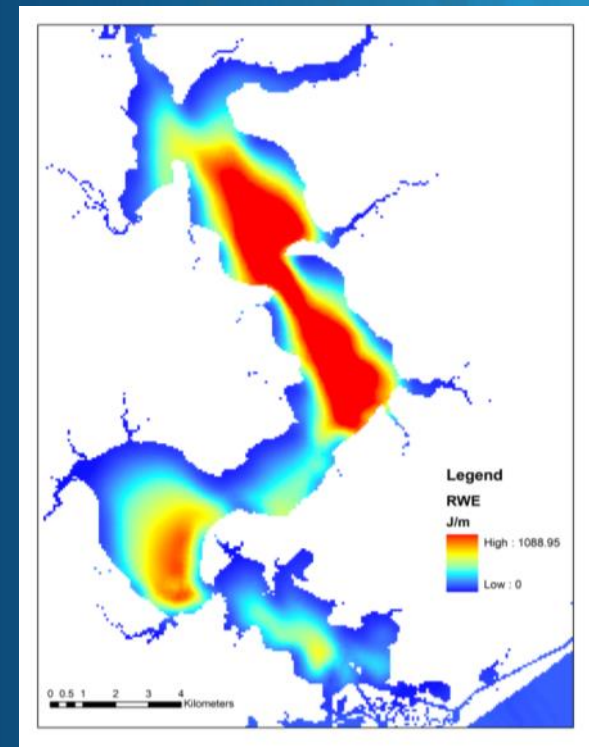
Mapped from small boat

Erosion Rate



Aerial photo. '56, '89, '04

Wave Energy



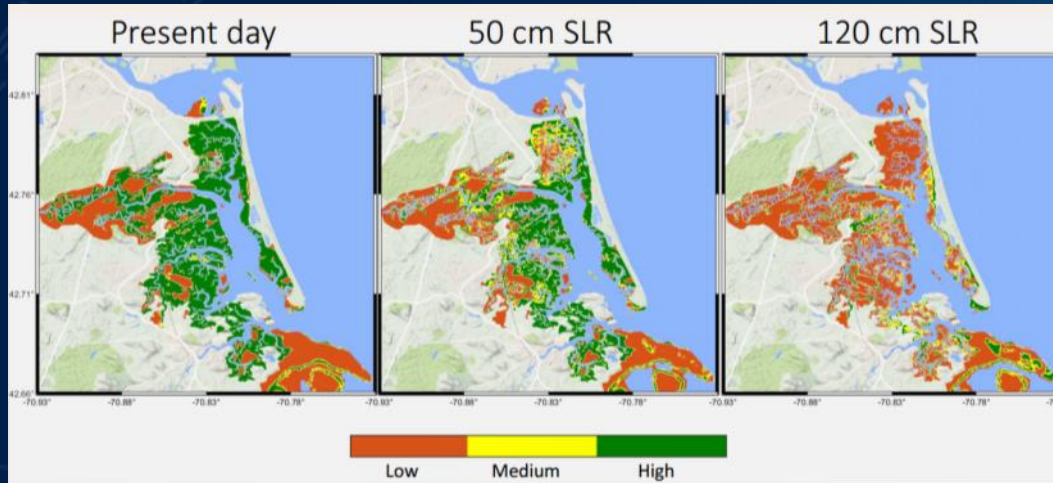
RWE from Wave Energy Model





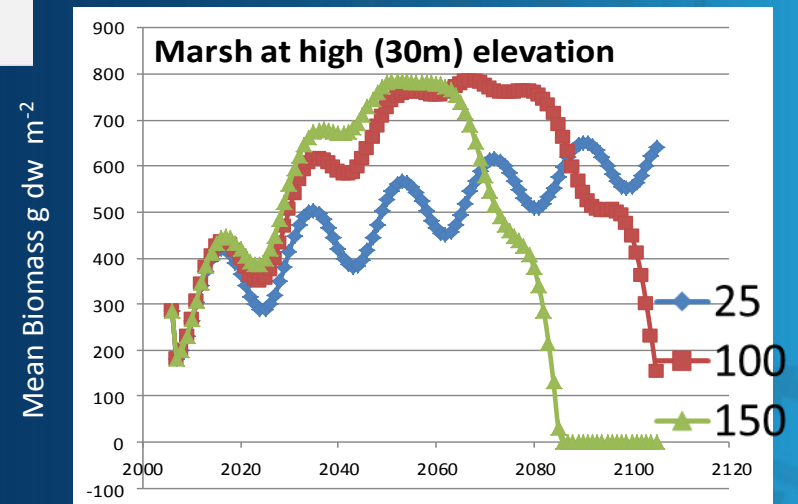
# Models and Tools

## Solutions to mitigate marsh vulnerability?



## SLR and marsh elevation scenarios (MEM model)

## Vulnerability and risk (Hydro-MEM model)

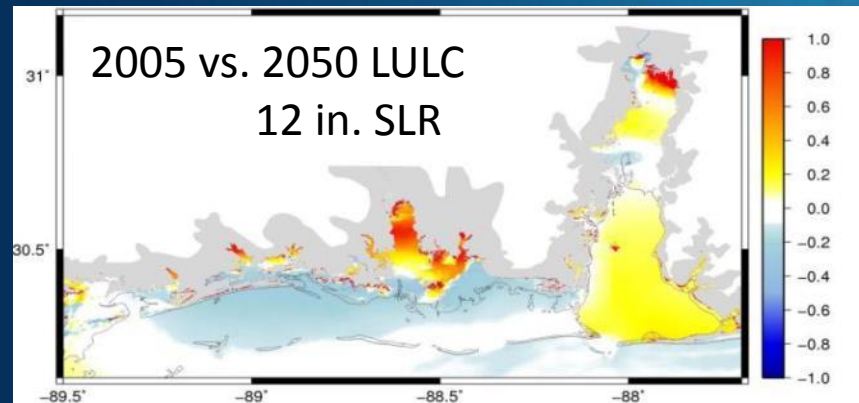
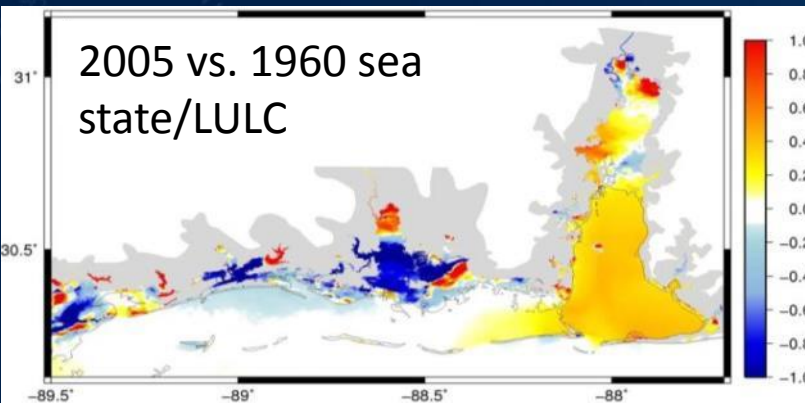




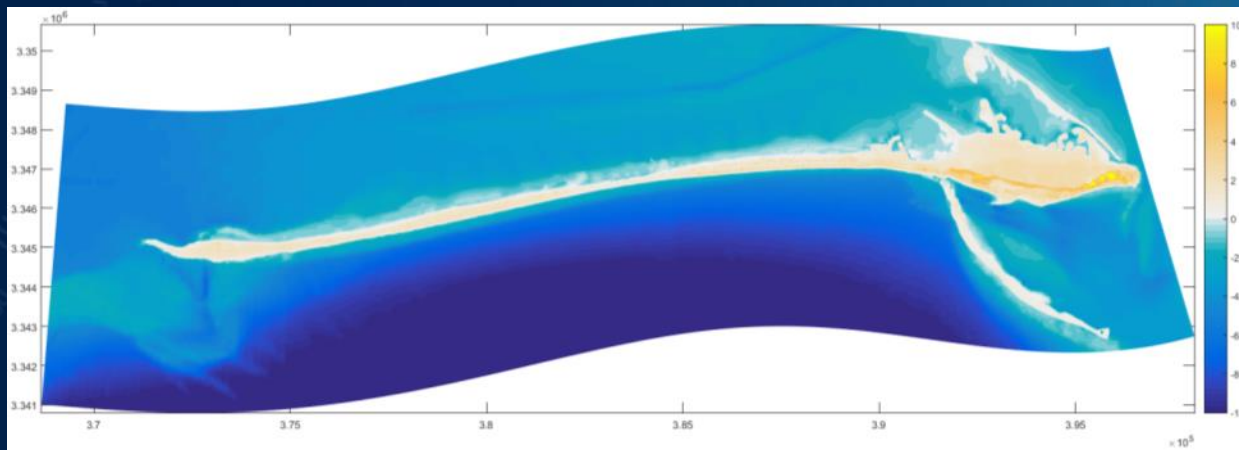
# Models and Tools

## What if Hurricane Katrina struck in 2050?

Dynamic Storm Surge (NGOM3)



Over wash and breaching of Dauphin Island

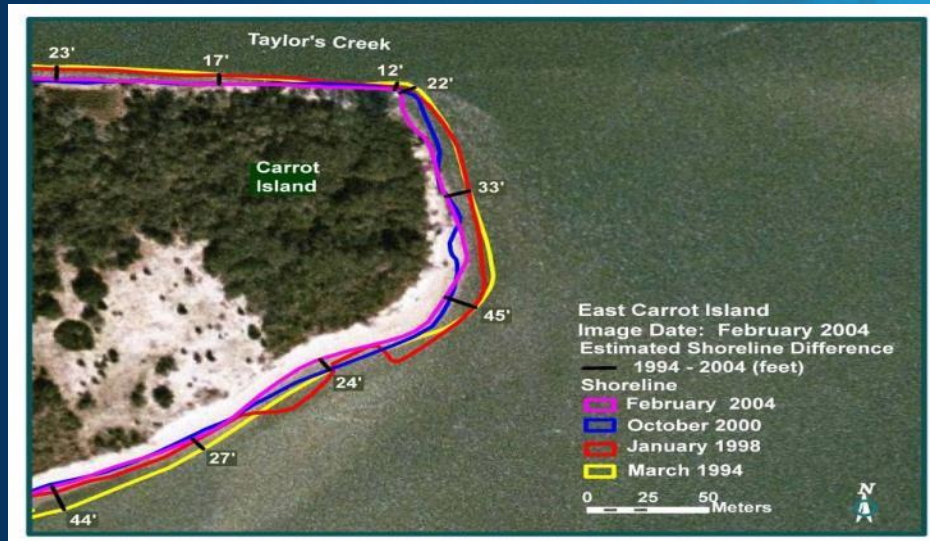
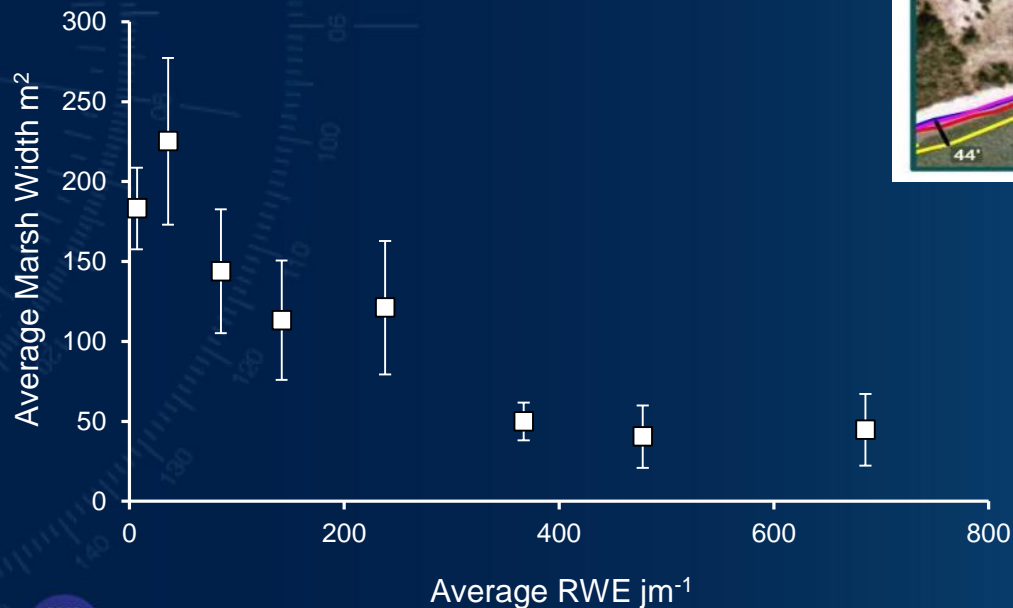




# Guidance and Metrics

How much wave energy can living shorelines sustain?

Rachel Carson National  
Estuarine Research Reserve  
demonstration



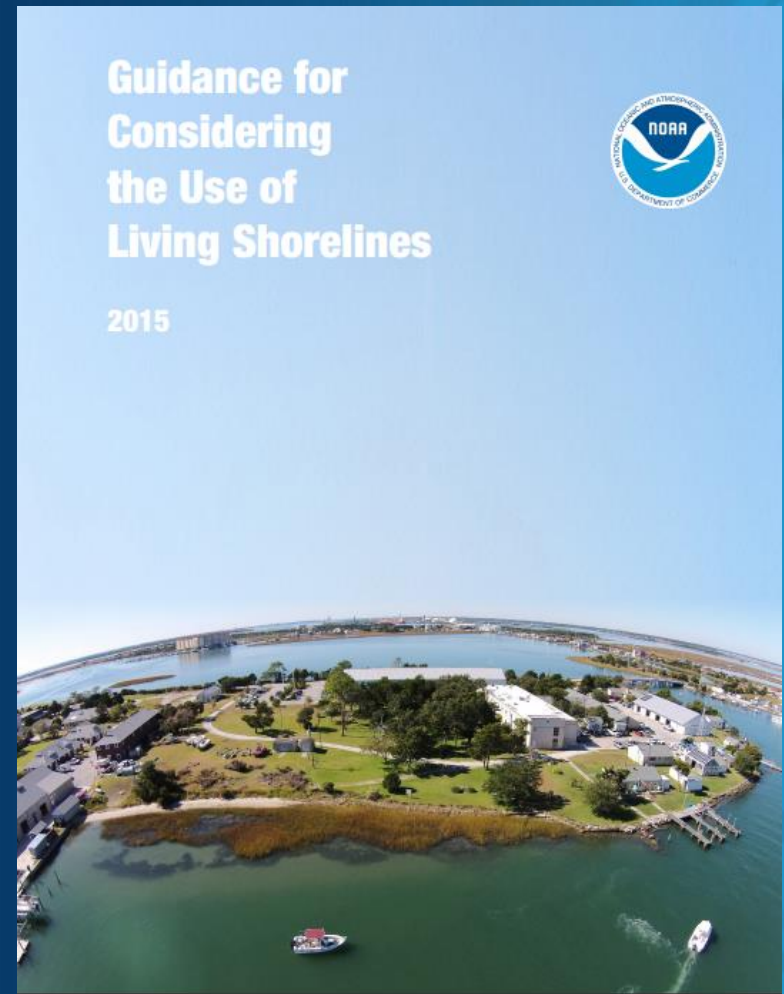
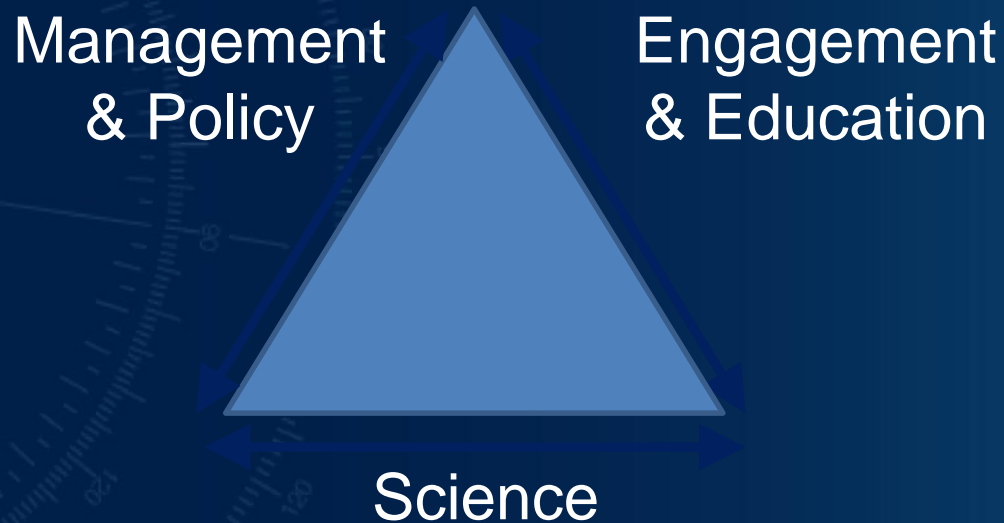
Fringing marsh distribution  
versus wave energy





# Guidance and Metrics

Guidance for installing a living shoreline?

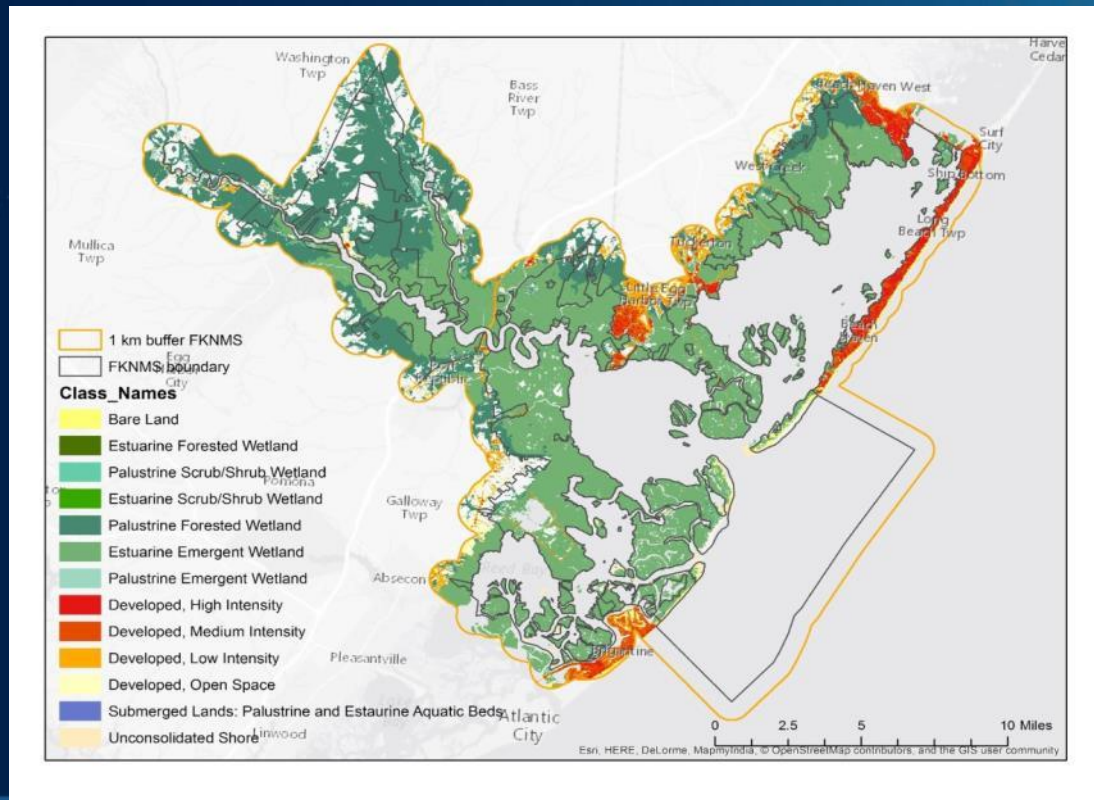




# Ecosystem Services

## What is the value of marshes for flood protection?

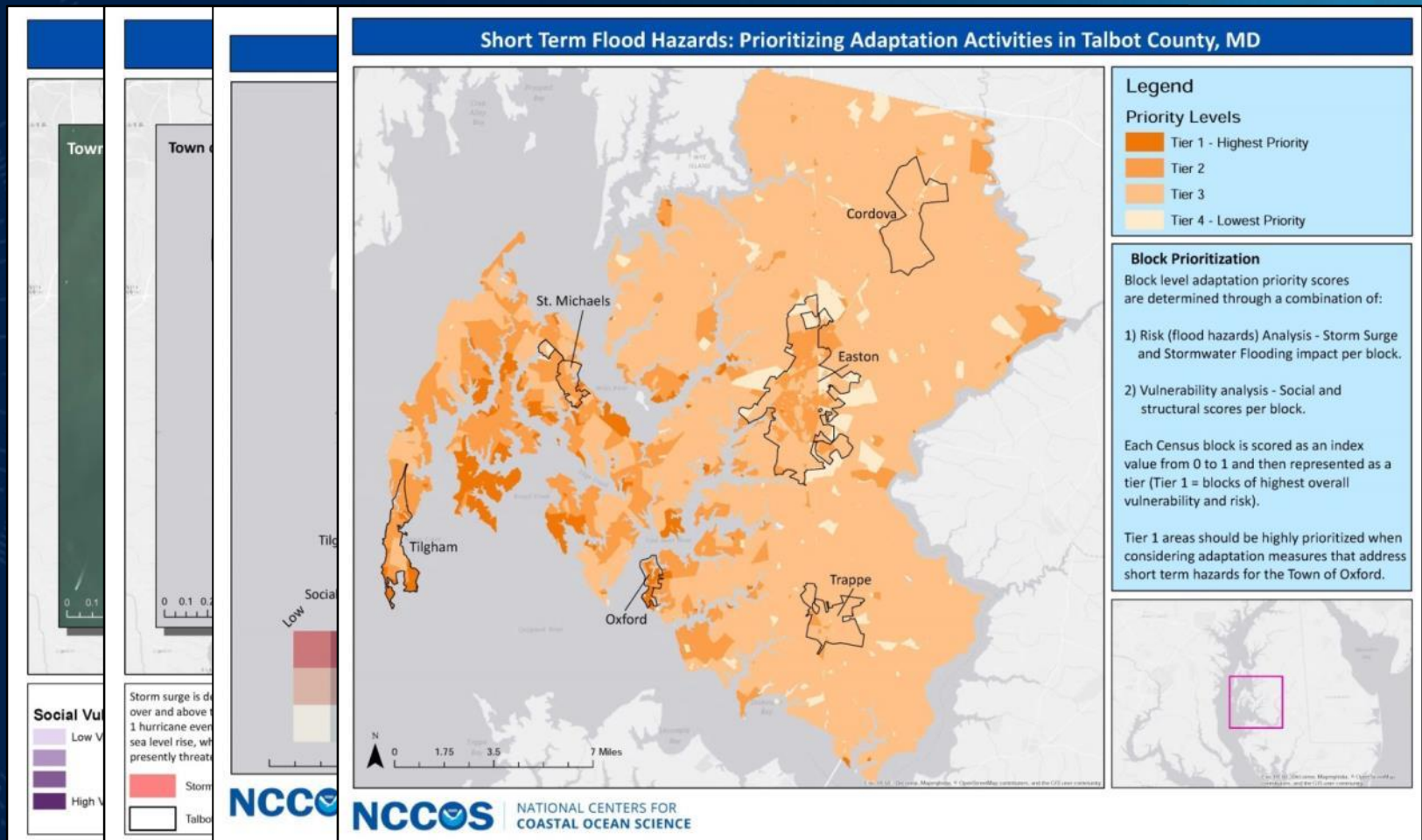
- Value (\$\$) of damages avoided by having natural habitats
- Value saved from reduced flood insurance costs
- Economic stimulus to the community





# Ecosystem Services

## How can our science inform adaptation?





# Emerging Opportunities

## Enhanced emphasis on NNBF in new projects

- Tools and models for scenario evaluations (Gulf and CA)
- Valuing ecosystem services (OR)
- Thin layer disposal of dredge spoil at Camp Lejeune (NC)

## NERRS Science Collaborative

- Living shorelines and erosion (FL)
- Performance of sustainable shorelines





# Conclusion

NOS capabilities to advance resilience and natural and nature-based features

- Coastal Management
- Coastal Intelligence
- Coastal Science

Strengthen application and facilitate implementation of NNBF  
Goal this week: Partnering to create a joint framework

